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Placing Our NORTHERN HARDWOOD WOODLOTS *Under Management*

by
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United States Department of Agriculture • Forest Service

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DO YOU OWN A WOODLOT? Does it contain mostly northern hardwoods--that is, beech, birch, maple, and ash, with some hemlock and spruce? If the answers to these two questions are "yes," then you may be interested in the work that is carried on at the Bartlett Experimental Forest in New Hampshire. This is one of the field laboratories established by the U. S. Forest Service to investigate forest problems and find methods of solving them.

In 1951, two areas on this forest were set aside for woodlot studies. We plan to improve these woodlots by making frequent light cuts. At the same time we would like to make a profit on the operations. At first, we will cut the poorest trees. Our goal is a stand of well-spaced fast-growing trees of good quality. The right species with a proper distribution of sizes will insure us of high-value products year after year.

Each year a cutting will be made in one or both of the areas. Cost and return records, kept separately for each woodlot, will give us a case history of each woodlot.

Each area is typical of many woodlots in the 8-million-acre northern hardwood region of Maine, New Hampshire, Vermont, and western Massachusetts. Each is located near gravel roads and is easy to log. Each is approximately 40 acres in size.

One woodlot has on it a large proportion of old-growth hardwoods (fig. 1), but many of these trees are of low quality and contain much unusable material. The best trees had been removed in logging operations about 60 to 70 years ago.

The other woodlot has on it mostly second-growth hardwoods and scattered large trees of low value (fig. 2). These stands came in after clear-cuttings as late as 1917.

Figure 1.--A typical old-growth hardwood stand in the old-growth woodlot. The trees are large, but many of them are crooked and rotten.

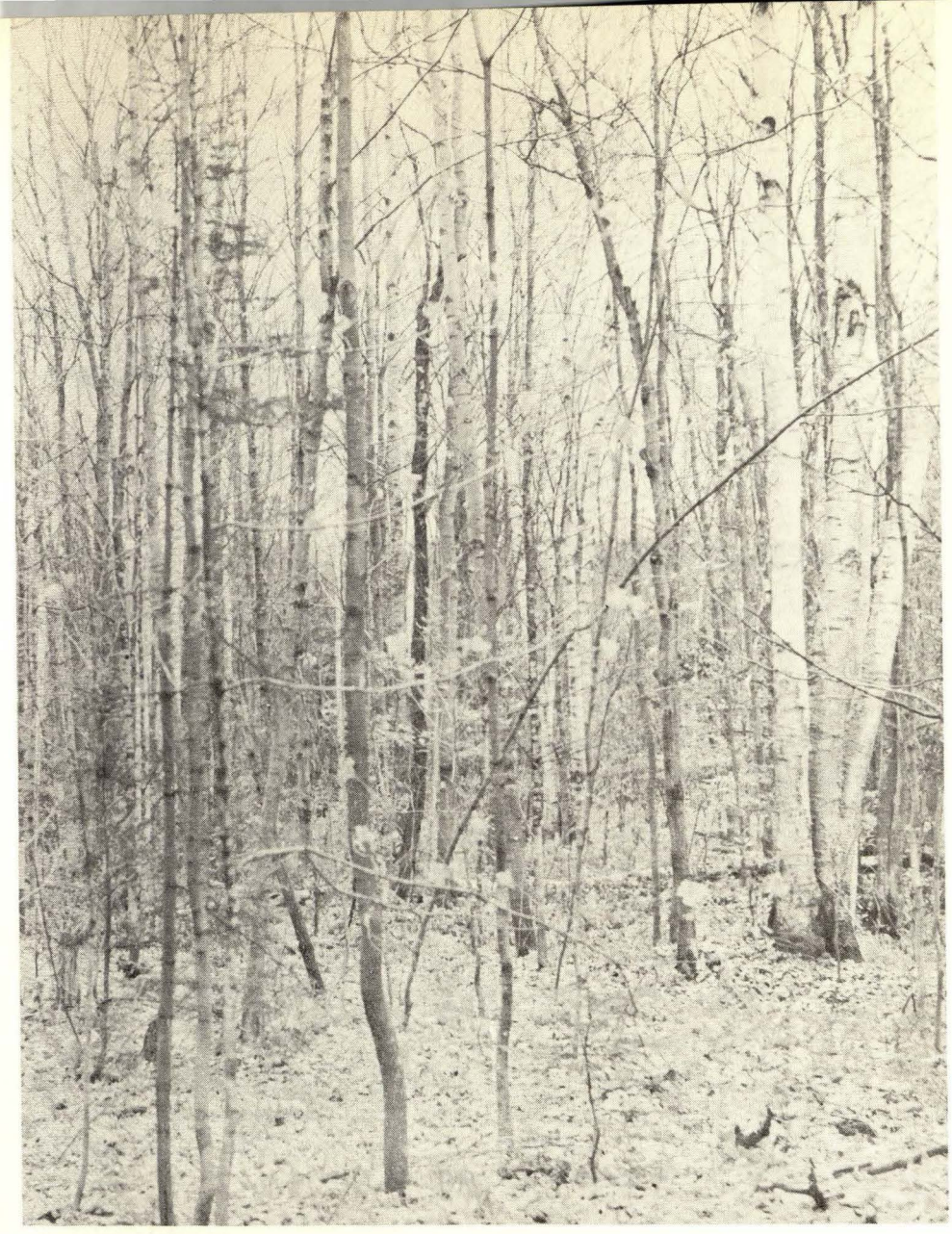

Figure 2.--A typical second-growth hardwood stand in the second-growth woodlot. The trees are small. The most common species are red maple, paper birch, and aspen.

The trees are small but many of them show promise of developing into valuable timber trees.

If your woodlot resembles either of these, you might like to see how we are handling them. Come visit us some time. The resident forester at the Bartlett Experimental Forest will be happy to show you around the woodlots, explain what has been done, and why it was done. You can com-

pare conditions with those on your own woodlot and get some helpful ideas for planning your own work program. If possible, write or phone to the Northeastern Forest Experiment Station office at Laconia, N. H., and make an appointment.

Many of you may find it impractical to visit the experimental forest. In that case, come along with the forester as he goes about placing these woodlots under management.

OLD-GROWTH WOODLOT

MAKING A RECONNAISSANCE

Let's start with the woodlot that has the largest trees. First of all, we want to know what is on the area and what condition the timber is in. On large ownerships, this is determined by making a timber cruise. But for a small woodlot, we can accomplish the same thing by carefully examining the area.

Armed with hand ax, an increment borer, and a rough map of the area, we start walking through the woodlot. The hand ax is mainly for sounding doubtful trees to find out if they are hollow. The increment borer is a useful tool for determining how fast a tree is growing. The map is used to sketch in stands and to make notes of the forest conditions (fig. 3).

The first part of the trip takes us through a low wet area. Many of the trees here are crooked and show signs of rot. We note this on the map. It may determine when we can log and how heavily we can cut in that area.

Then we climb a gentle slope to a low wide ridge. Here we find many beech. A few of the largest trees have died, and some of the others have thin, yellowish tops. A look at the trunks of these trees tells us the reason: beech scale-Nectria. The scale is a small sucking insect that attacks the bark of the tree (fig. 4). The Nectria disease follows, often killing the tree. The small dark-red fruiting bodies[1] of the Nectria are easily seen on the infected bark. In this area, the problem is serious but, at the same time, simple. These dead and dying trees have to be cut soon or they will be lost.

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[1]When viewed through a magnifying glass, these fruiting bodies resemble small clusters of grapes.

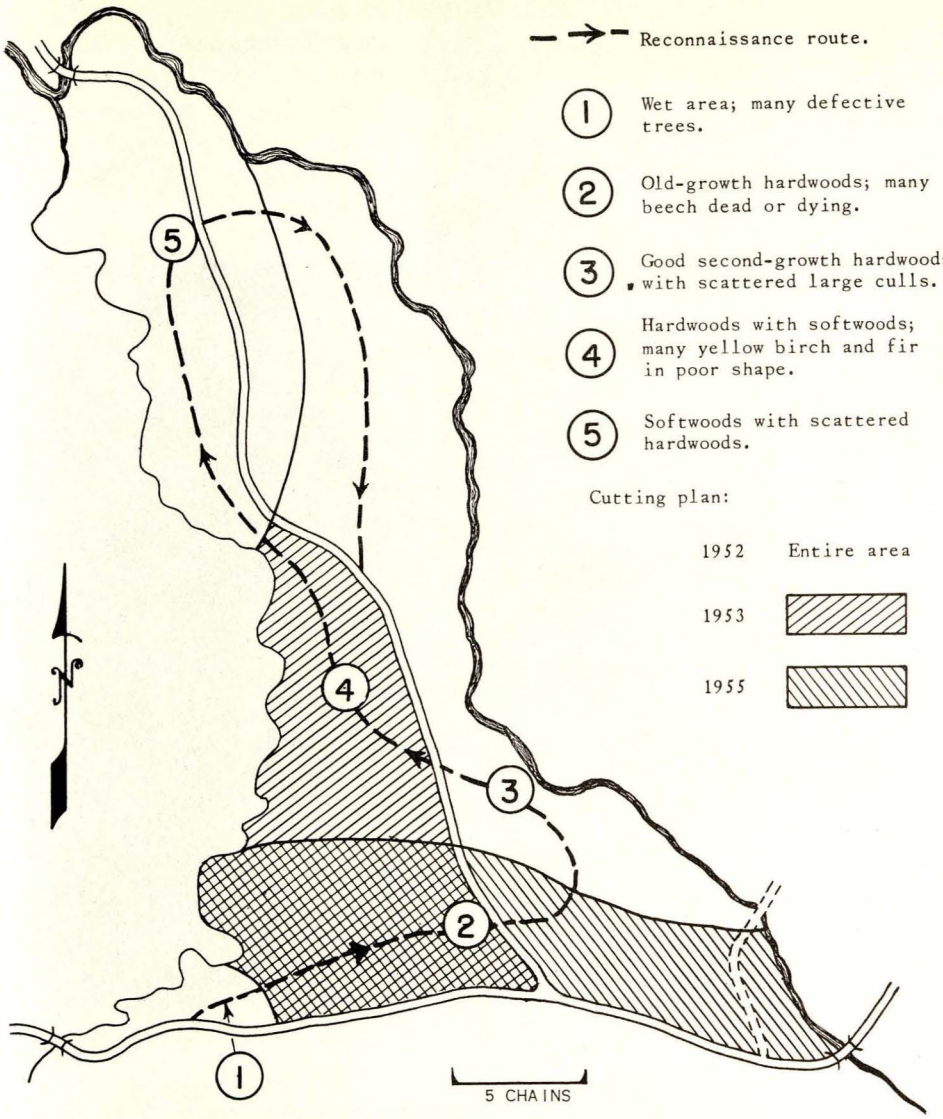
Reconnaissance route.
1 Wet area; many defective trees.
2 Old-growth hardwoods; many beech dead or dying.
3 Good second-growth hardwoods with scattered large culls.
4 Hardwoods with softwoods; many yellow birch and fir in poor shape.
5 Softwoods with scattered hardwoods.
Cutting plan:
1952 Entire area
1953
1955
N
5 CHAINS

Figure 3.--Map of the old-growth woodlot, showing stand conditions and cutting areas.

In another part of the woodlot, we note that most of the trees are second-growth trees of good form and vigor (fig. 5). We bore some of them and examine the growth rings of the past few decades. We find that even the larger white ash are maintaining a good rate of growth. A few trees are being crowded out of the stand. But these are small, most of them too small to pay their way in a logging operation. In this area, the biggest need is to get rid of a few scattered wolf trees. This will maintain, or even improve, the growth rate on the remaining trees.

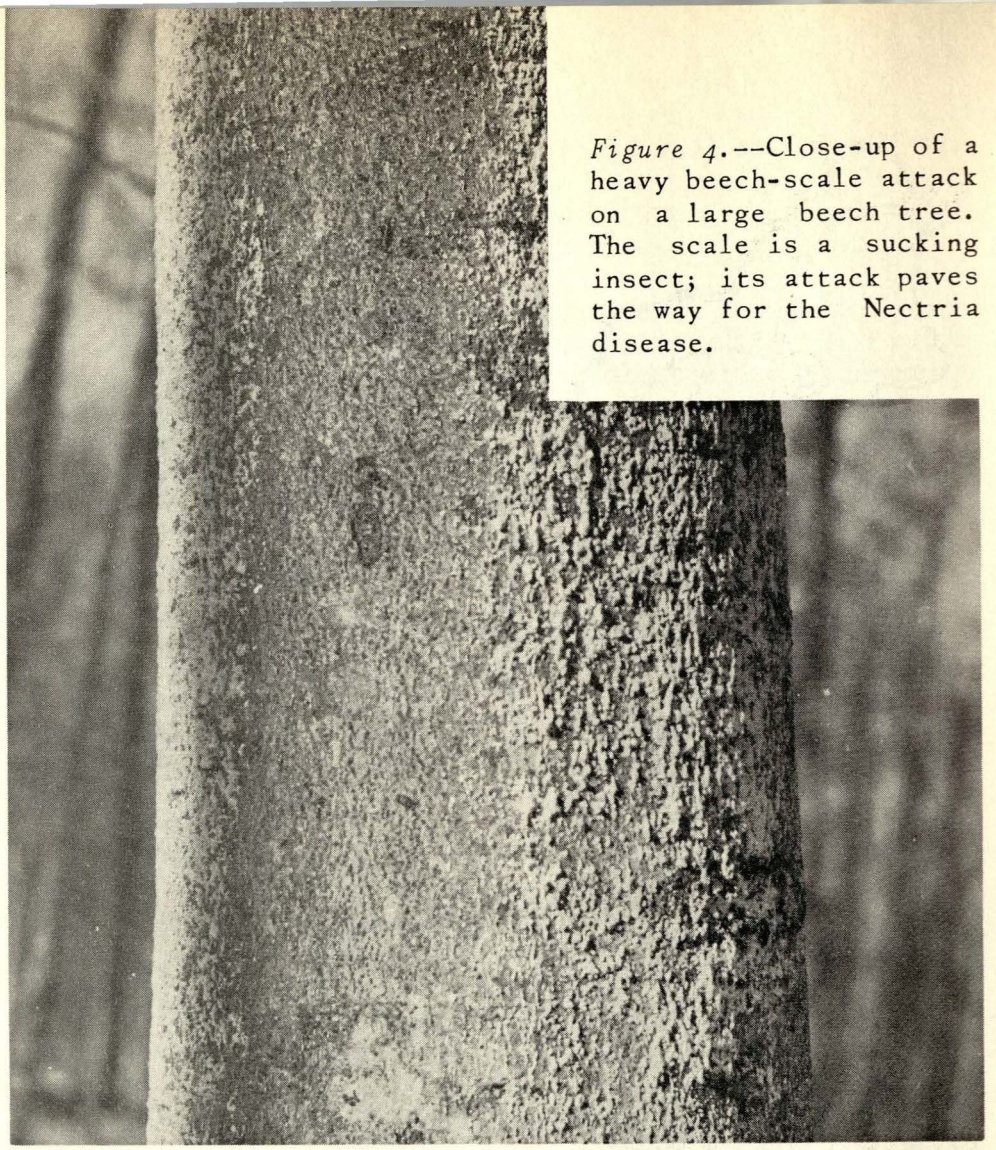

Figure 4.--Close-up of a heavy beech-scale attack on a large beech tree. The scale is a sucking insect; its attack paves the way for the Nectria disease.

Now we swing back into another low section. Here we begin to find some softwoods--hemlock, fir, and a few spruce. These trees, except for the fir, are in good shape. Yellow birch is the most prominent hardwood here; many of these are more than 20 inches in diameter. But a blow with the ax tells us that some of them that look sound are actually hollow. Also, some have thin, ragged crowns; they won't live much longer.

As we move on in this direction, we find more and more softwoods, until finally we see only scattered hardwoods (fig. 6). These are mostly red maple of poor quality. The stand would be much better off without them. On this site a pure softwood stand would be more valuable than a mixed stand. Otherwise the stand is in good shape.

That completes our reconnaissance. In about half a

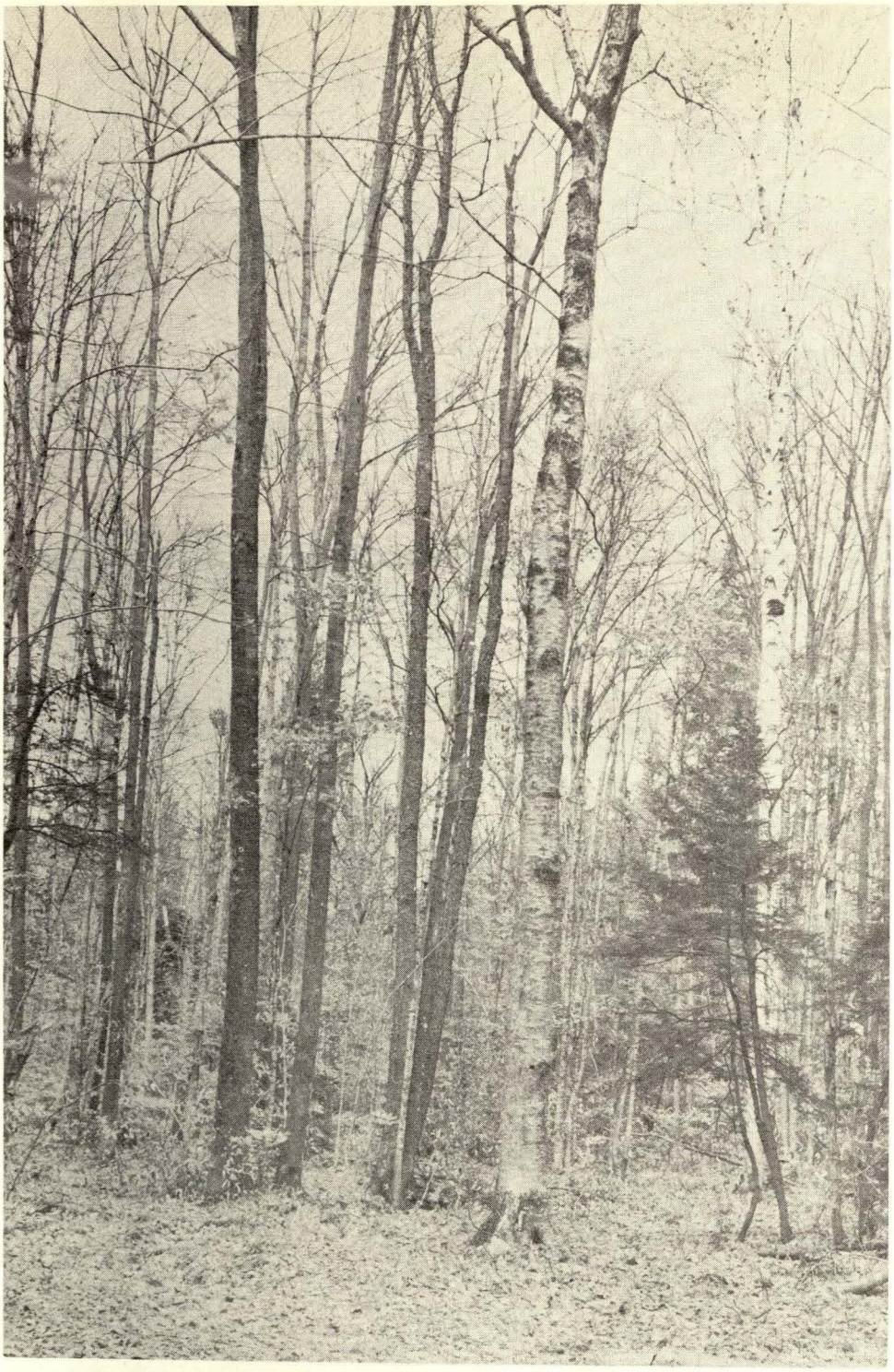

Figure 5.--A 70-year-old second-growth stand covers part of the old-growth woodlot. Most of the trees here are of good form and vigor.

day we have got a good idea of what was on the 43-acre woodlot, and its condition.

DECIDING HOW TO TREAT THE WOODLOT

Now we have to decide what we want to do. Should we log the area? If so, how much should we remove? What parts of the area should we log? At what season of the year should

Figure 6.--A dense softwood stand is found in one part of the old-growth woodlot. A few hardwoods, generally of poor quality, are scattered among the hemlock and spruce.

we do the logging? How should we do our logging?

The first question is easy. There are so many large dead and dying trees on the area that we should start logging as soon as possible.

But when it comes to how much to remove, we have to consider our pocketbook as well as the condition of the stand. Do we want returns every year or two? Or do we want to take a greater return now and then wait 5 or 10 years before we get any more? We decide on the first alternative. That means we'll have to make a light cut and reserve enough trees for future cuts. The best way to do this is to remove at this time only those trees that are not likely to last until the next cutting, together with some of the poorest quality trees.

Our reconnaissance showed that the entire area was in need of some sort of treatment, either to increase its potential value or to salvage dying trees. So for this first cut we shall cover the entire woodlot. Cutting will be light in some of the areas such as the softwood and the second-growth stands. In the area where the large beech are dying, the cutting will be heavy.

We should also plan ahead and decide where to cut next year and again 3 years from now. The areas in worse shape, especially those with a high proportion of beech, are the ones we can cut each time. The better areas, such as the second-growth and softwood stands, we can cut now and wait for another 5 years or so before we cut again. We sketch these cutting areas on the map. When the time comes for the second and third cuts, we don't have to limit ourselves to these areas, though. We can always change our minds depending on market and stand conditions.

At what season of the year should we do the logging? Deep snow or mud could prevent us from logging in the winter or spring; but we can log any time from May until January. Since it fits in more conveniently with our other work, we decide to do the logging in September and October.

Nor is the method of logging a serious problem. The equipment we use depends largely on what we have available. Either horses or a small crawler-type tractor can be used. The land is too rough and the logs too big for the average rubber-wheeled farm tractor.

We can either do our own logging or--since this is an attractive chance--we can hire someone to do it for us. At the Experimental Forest we don't have any logging equipment,

so we have to have someone else do the logging. We do this by making stumpage sales.

MARKING THE WOODLOT

Therefore, we have to mark the trees to be cut. We can use either a marking ax or a paint gun. We decide on the paint gun. When we mark a tree for cutting, we spray two spots on the trunk--one at eye level and the other at the base. This not only designates the trees, but also makes it possible to check the logger's compliance with our marking.

Out in the woods, we find that most trees "mark themselves"; that is, there is usually little question whether a tree should be cut or kept. It is the few borderline trees that give us trouble.

One problem is to keep the cut low. There are just too many poor trees taking up space that should be occupied by good trees. Some of them will have to be left for future cuts. Another problem is that we have to keep in mind where we plan to make the next two cuttings. Thus our two main considerations are: Will the tree last until the next cut? And will it pay its way?

Let's take a closer look at some of the questionable trees on this lot. Over there is a large rough beech. It's too rough to get even an 8-foot log out of; but it will yield three large pulpwood bolts. The tree shows no signs of dying; it has a large healthy crown and no signs of Nectria. In fact, the crown is so large that it takes up growing space badly needed by some promising nearby poles. We'd like to get this tree out of the stand as soon as possible; but it's a long way from the road, and we think it won't pay its way. In this case, it would be cheaper to girdle it than to cut it for pulpwood. If the tree had Nectria, we wouldn't girdle it, because there is a good chance it would die. Yet suppose the tree had been closer to the road; then it would have paid its way and we would have marked it for cutting.

How about that paper birch we just passed? It has a poor top; it can't last much longer. But our reconnaissance showed that we had little paper birch on the area, and most of it was in rather good condition. Paper birch brings a high price when sold for boltwood, but a low price for pulpwood. Therefore we will take a chance that this tree will last until the time we decide to cut enough paper birch to make up a load of boltwood.

Here is a 7-inch birch tree with a poor top. By itself, it won't pay its way. But if there are others close by that are to be marked, it can be cut and skidded out with them at only a little extra cost.

Here is another large defective tree. It would just pay its way. But as we look around we note that it would be impossible to fell it without destroying or damaging a number of very promising poles. So we leave it to be girdled after logging.

This large yellow birch I've been sounding with my ax is hollow at the butt. But how far up does the hollow go? Probably all the way up the trunk. However, let's mark it. We may be wrong, and by long-butting it we may get a lot of valuable high-grade lumber. It's worth the small extra cost to find out (fig. 7).

You ask why I'm marking this nice 12-inch white ash. Well, over there is a 22-inch yellow birch of high quality that is dying. It's leaning right into this white ash. It would be almost impossible to fell it without destroying the ash tree. So we'll mark them both. We are sacrificing the future valuable growth on the ash to realize the present high value in the birch.

Figure 7.--A large yellow birch with hollow butt on the old-growth woodlot. Such trees were marked for cutting because they may contain some high-quality lumber in the upper log.

These are just a few of the problems we encounter. We soon learn that we must judge each tree on a number of points--species, form, quality, size, location, vigor, and relationship to surrounding trees in the stand. At the same time we must keep in mind the present market conditions and our cutting plans for future years.

LOGGING THE WOODLOT

After we complete the marking, we show the areas to our operator. He decides to use a two-man crew with chain saws. The men will be equipped with a small crawler-type tractor and paid at the rate of $8.00 per cord and $16.00

Figure 8.--The old-growth woodlot was logged by a 2-man crew using power saws and a T-6 tractor.

per thousand board feet for the products at roadside (fig. 8).

While the logging is going on, we visit the lot frequently. We still have a large investment in the trees to be kept; so it is important to us to make sure the cutters do a careful job, with little damage to the remaining stand. Also, since we made the sale on a log-scale basis, we should make sure that the trees are being cut into the best products with little or no waste. But most of all, we are interested in seeing just how the material "cuts out." This knowledge will be helpful when we mark the lot in future years.

Table 1.--Volume and value of products removed from the old-growth woodlot, 1952 cut

Product	Volume produced		Roadside value	
			Per unit	Total
	M bd.ft.	Cords	Dollars	Dollars
Veneer logs	22.550	--	38.00*	856.90
White ash logs	2.416	--	58.72**	141.87
Softwood logs	2.060	--	36.19*	74.55
Pulpwood	--	121.5	14.75*	1,792.12
Total	27.026	121.5	--	2,865.44

*Varies according to species.

**Varies according to log size.

It took 8 weeks during August, September, and October to log the woodlot. The weather was good, and the crew worked efficiently. There was very little lost time because of equipment breakdowns. These factors, together with the piece-rate wages, resulted in a high crew productivity.

After the logging was completed, a man was hired to girdle the cull trees that showed no signs of dying in the near future. These were the trees too rotten, too crooked, or with too many large branches to be merchantable now or in the foreseeable future. They also included trees that had been badly damaged in logging. It is good business to remove

these culls so that young, thrifty trees can take their place.

The first cut was made to improve the woodlot. We also had hoped it would be a profitable one--for the operator as well as the owner. The results of the improvement will be more apparent as time goes by. But we can determine exactly what returns the operation yielded.

A total of 27,026 board feet of sawlogs and 121.5 cords of pulpwood were removed. The products were marketed by the stumpage purchaser to get the highest returns: ash logs were sold for handle stock; softwood logs were sold for lumber; other hardwood logs were sold for low-grade veneer logs (roughly comparable in quality and value to logs sold for lumber); and the rest was sold for pulpwood (table 1). If local markets for them had existed, fuelwood and posts could have been cut from the tops and from the low-quality small trees.

COSTS & RETURNS FROM THE IMPROVEMENT CUT

This woodlot operation yielded good returns to everyone concerned--the workers, the operator, and the owner (table 2). The piece-rate wages, when translated into hourly rates, amount to $2.25 per hour. This was considerably higher than the local going wage rate of $1.25 per hour for woods labor. Under the piece-rate system, however, the workers have a much greater incentive for producing.

The operator's returns after he had deducted equipment and labor costs, taxes, and stumpage costs were over $350. Included in this amount are such items as compensation, insurance, social security, interest on operating capital, and an allowance for risk. His costs, other than his labor costs, are based on the following rates:

Item	Rate
T-6 Tractor	$2.25 per elapsed hour
Power saws	$1.00 per M bd. ft. or cord
Miscellaneous equipment	$0.10 per M bd. ft. or cord
Severance tax	7% of stumpage
Marking paint	$4.50 per gallon

In this stumpage sale, the owner's returns amounted to almost $700. Of this, he spent almost $100 for management work. This work consisted of marking the trees for cutting, and girdling cull trees. There are also two other costs he must consider--the tax on the land and the interest

Table 2.--Financial summary of improvement work on the old-growth woodlot, 1952 cut

Item	Costs and returns	Returns to owner
Roadside value	$2,865.44	
Equipment and tax[1]	574.11	
	2,291.33	= returns if owner does own work.
Labor costs (logging)[2]	1,244.25	
	1,047.08	= returns if owner marks timber and hires loggers.
Operator's returns	354.49	
Stumpage	692.59	= returns if owner sells stumpage and does his own marking and cultural work.
Labor costs (marking)[3]	72.00	
Labor costs (girdling)[4]	25.00	
	595.59	= returns if owner sells stumpage and hires timber-marker and cull-girdler.

[1]Includes tractor, power saws, miscellaneous tools and equipment, marking paint, and severance tax. Tractor costs are based on 155 hours of elapsed time.

[2]Based on 553 man-hours.

[3]Based on 36 man-hours.

[4]Based on 20 man-hours.

on the investment. These are fixed costs and have to be considered each year whether or not any cutting is done.

SECOND-GROWTH WOODLOT

MAKING A RECONNAISSANCE

Let's see what we have on the other woodlot--the one with the small second-growth trees. As we walk through the area, we are surprised to find such a wide variety of con-

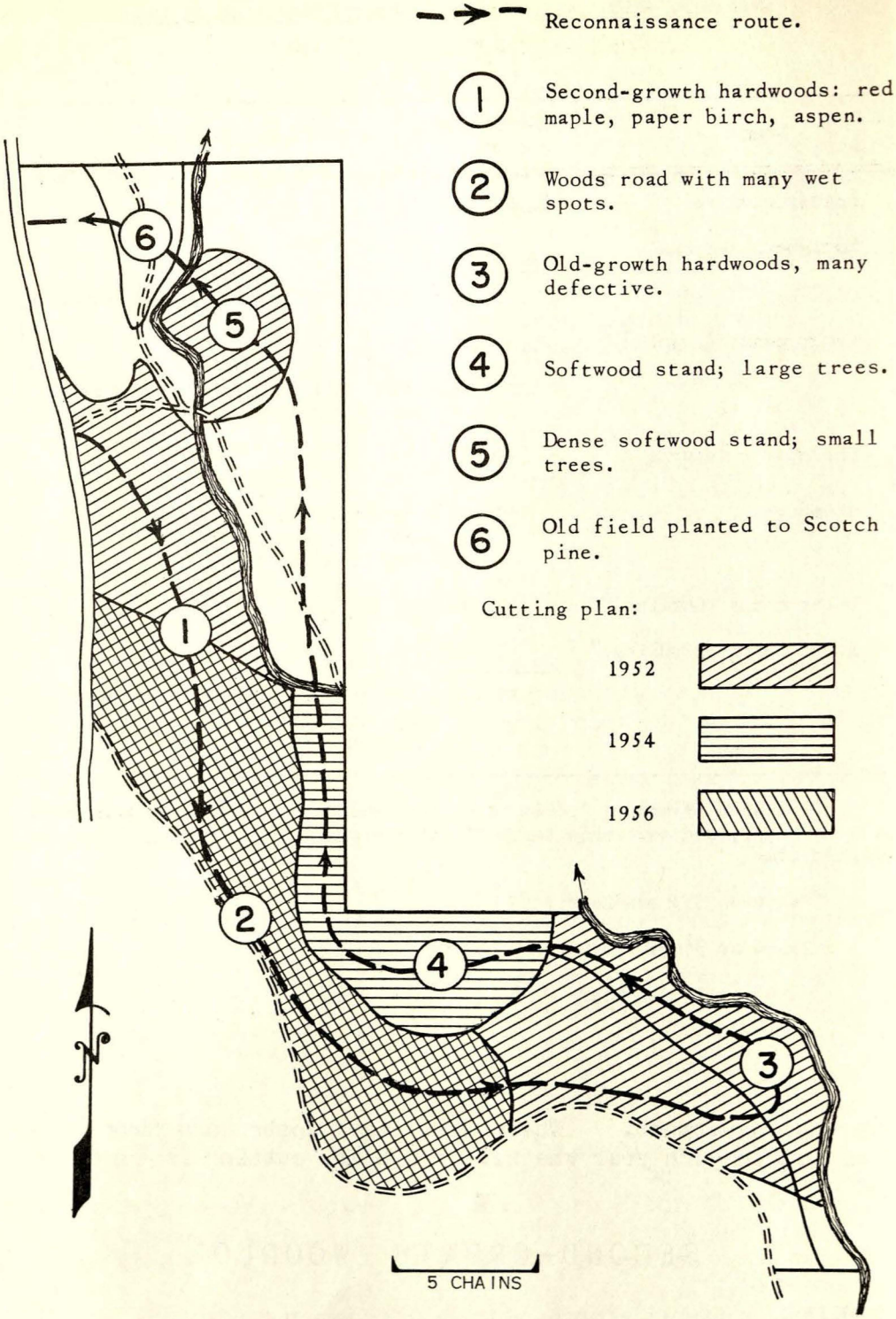

Figure 9.--Map of the second-growth woodlot, showing stand conditions and cutting areas.

ditions (fig. 9). First of all, there's a typical stand of second-growth hardwoods. Red maple, much of it in sprout clumps, is the most common species. We also have some nice clean-looking paper birch and some rather poor-looking aspen. Much of the aspen--a short-lived species--is dying.

The trees are small--in some areas, too small to be merchantable. In other areas only the paper birch trees are large enough to make a logging chance attractive.

As we walk along the old logging road bordering the lot we note that we won't be able to use it as a truck road; it has too many wet spots.

Along the brook in the far corner of the lot are a number of large old hardwoods. These were left in past cuts because they were too hard to reach and were too poor in quality. These are earning the owner very little money and are crowding out the younger, more valuable trees. The sooner we get the worst ones out of the stand the better. Some of them can be cut and used; others will have to be girdled.

We then come into a pure softwood stand. Most of the trees are hemlock. There are also some spruce, fir, and a few scattered large pine. This stand is in good condition. However, a thinning would result in better and more valuable growth.

Farther down the stream we come to another pure softwood stand. Unlike the other one, though, this stand is very dense and the trees are small (fig. 10). This stand needs thinning badly to increase the rate of growth on the better stems. The fir trees in this stand, though small, are old; and many have developed heart-rot. They should be cut.

After leaving this softwood flat, we cross the brook again and come upon an old field. In 1929 this field had been planted with Scotch pine. These pines are so crooked that few, if any, will ever develop into good trees. Eventually we should give some thought to converting this into a productive stand. If at some future date a good pine pulpwood market develops, we may be able to cut most of the trees.

DECIDING HOW TO TREAT THE WOODLOT

That finishes our reconnaissance. Should we make a cutting in this woodlot? That question is hard to answer. The trees are too small to yield much of a profit. Unlike the other lot, there are few trees to be salvaged; and these

Figure 10.--The very dense stand of softwood poles in the second-growth woodlot. The balsam fir and the rougher hemlock should be removed in a thinning cut.

few are low-value fir and aspen. Still, we could improve the woodlot by getting rid of material that has little present or future value, and by making thinnings in areas that need it. It's worth a try.

Before we decide definitely, let's get the opinion of the county forester. He has had a lot of experience in managing small woodlots. Undoubtedly other owners have sought his advice on similar questions. So once again we look over the woodlot, this time accompanied by the county forester.

As we walk through the woods, we tell him just how we would like to treat the woodlot. After he has seen it, he tells us he doesn't think we could find an operator who would be willing to cut the small and scattered timber unless the stumpage charge were very low.

We decide to accept the low stumpage rate and go ahead with the cutting. We may not make much money on this cut, but we think it may be a good investment.

Our next problem is to draw up our cutting plan. Where shall we cut this year and in subsequent years? The best way to improve the woodlot is to make a light cut over the entire lot, at least that part that contains merchantable material. But then, where can we make the next cutting--2 years from now? The softwood stand with the larger trees would be a good place. The trees there are healthy and the thinning could easily be postponed for 2 years. So we exclude this stand from the present cutting operations. For our third cut, we could probably go back into the second-growth hardwoods. At that time we could take out some more of the red maple clumps and the less promising paper birch.

This lot has some wet spots in it too. Therefore, logging should be done in the early winter or during a dry period. Since it fits in with our other work, we decide to do it in November and December.

Like the other woodlot, this lot can be logged with either horses or a small crawler-type tractor. The choice depends upon what we have available.

MARKING THE WOODLOT

In marking this lot, our first consideration is to salvage the dead and dying trees. We should also remove poor trees that are competing with better trees--trees that will eventually produce valuable products. We especially want to get rid of some of the worst red maple clumps (fig. 11). We shouldn't worry about opening up patches in the stand, for the seedlings of some of our best species, such as ash and birch, require considerable light for proper development.

We must remember that we are working with small trees of low value. For example, that 6-inch aspen over there has a very poor top. It will probably die in a year or two. Should we mark it for cutting? This tree is a considerable distance from the landing. We think it won't pay its way,

Figure 11.--A red maple clump marked for cutting on the second-growth woodlot. Such clumps often contain rotten and crooked trees and take up valuable growing space.

Table 3.--Volume and value of products removed from the second-growth woodlot, 1952 cut

Product	Volume produced		Roadside value	
			Per unit	Total
	M bd.ft.	Cords	Dollars	Dollars
Veneer logs	3.710	--	37.60*	139.50
White ash logs	.747	--	59.40**	44.37
Softwood logs	.780	--	32.50*	25.35
Paper birch boltwood	--	13.76	29.50	405.92
Pulpwood	--	54.04	14.20*	767.37
Total	5.237	67.80	--	1,382.51

*Varies according to species.

**Varies according to log size.

so we will just leave it there to die. If it had been located close to the landing, we could have salvaged it at a profit.

How about that clump of red maples? They are healthy, but they are so crooked and are taking up so much space that we would like to get them out of the stand. By themselves, they won't pay their way. But if we mark a few of the nearby trees--for example, that aspen and that paper birch--we can make the logging easier and less expensive per tree. Then the red maples will pay their own way.

Occasionally we mark a good paper birch tree. We do this to "sweeten" the cut and make it a more attractive chance.

LOGGING THE WOODLOT

After we complete the marking, we show the area to our operator. He decides to use a 4-man crew with a small crawler-type tractor. Two of the men will work at the landing, bucking logs and loading trucks. One man will do the felling and one will do the skidding. The material will be removed in tree lengths and bucked into logs and bolts at the landing. These men will be paid at the rate of $1.25 per hour.

It took 4 weeks during November and December to cut this woodlot. Unfavorable weather delayed the operation and made logging more expensive. Production also lagged because the workers were paid on an hourly basis rather than on a piece-rate basis. There is also some question as to whether the crew organization was as efficient as on the other woodlot.

Once again, the products were marketed to get the highest returns (table 3). So much of the material was in small trees that pulpwood, together with paper birch boltwood, made up almost all of the cut.

Table 4.--Financial summary of improvement work on the second-growth woodlot, 1952 cut

Item	Costs and returns	Returns to owner
Roadside value	$1,382.51	
Equipment and tax[1]	428.74	
	953.77	= returns if owner does own work.
Labor costs (logging)[2]	716.88	
	236.89	= returns if owner marks timber and hires loggers.
Operator's returns	145.56	
Stumpage	91.33	= returns if owner sells stumpage and does his own marking and cultural work.
Labor costs (marking)[3]	48.00	
Labor costs (girdling)[4]	6.25	
	37.08	= returns if owner sells stumpage and hires timber-marker and cull-girdler.

[1]Includes tractor, power saws, miscellaneous tools and equipment, marking paint, and severance tax. Tractor costs are based on the following hours of elapsed time: D-4 with blade, 2 hours; D-4 without blade, 78 hours; T-6, 50 hours.

[2]Based on 573½ man-hours.

[3]Based on 24 man-hours.

[4]Based on 5 man-hours.

COSTS & RETURNS FROM THE IMPROVEMENT CUT

This woodlot operation gave lower returns to everyone than the first woodlot (table 4). The timber was smaller. The products removed had less value. Nevertheless, the operator did make a profit and the owner received a stumpage return. The laborers earned $1.25 per hour, which is the average rate for woods workers in the region.

The operator's return after he had deducted equipment and labor costs, taxes, and stumpage costs was almost $150. His costs are based on the following rates:

Item	Rate
Labor	$1.25 per hour
D-4 tractor with blade	3.00 per elapsed hour
D-4 tractor without blade	2.75 per elapsed hour
T-6 tractor	2.25 per elapsed hour
Power saws	1.00 per M bd.ft. or cord
Miscellaneous equipment	.10 per M bd.ft. or cord
Severance tax	7% of stumpage
Marking paint	4.50 per gallon

The owner received less than $100 for stumpage. Of this, he spent more than $50 for marking trees for cutting and for girdling small trees. The true value of this improvement cut, however, is not in the immediate returns but in the prospect of greater future returns.

Because of the small trees, this lot would have been an attractive chance for the owner to log himself. Assuming he could have done the job as efficiently as our operator, he could have taken in almost $1,000. This would have amounted to $1.60 per hour, a good wage for woods workers in this region.

DISCUSSION

If the owner of these woodlots had had the time, equipment, and ability to do his own work, he would have taken in considerably more money. The total amount he takes in depends mostly upon how much he is willing to put into the operation (tables 2 and 4).

At one extreme, he can sell everything on his lot for a lump sum. In this case, about all he has to do is sign the contract and pocket the money. But it would be years before he would get another cent from that lot.

Much better for long-time forestry and financial purposes is to make an improvement cut and sell the stumpage. If he hired someone to mark the timber, it would require only a little more of his time than a lump-sum sale. The owner would have to check up on the job occasionally to make sure the operator was complying with the rules of the contract.

He could also make a stumpage sale after marking the timber himself.

Or he could hire men to do the cutting, and supervise the operation himself. This would require considerably more responsibility and more of his time. But he would be in a position to get a higher cash return than if he had made just a stumpage sale.

Finally, he could do most of the work himself. The wages he would have paid would go back into his own pocket. However, this would mean that for a good part of the year he would have to give almost full time to the operation. This is probably the best method for a farmer who owns the necessary equipment and who has spare time in the fall and early winter.

Agriculture-Forest Service-Upper Darby